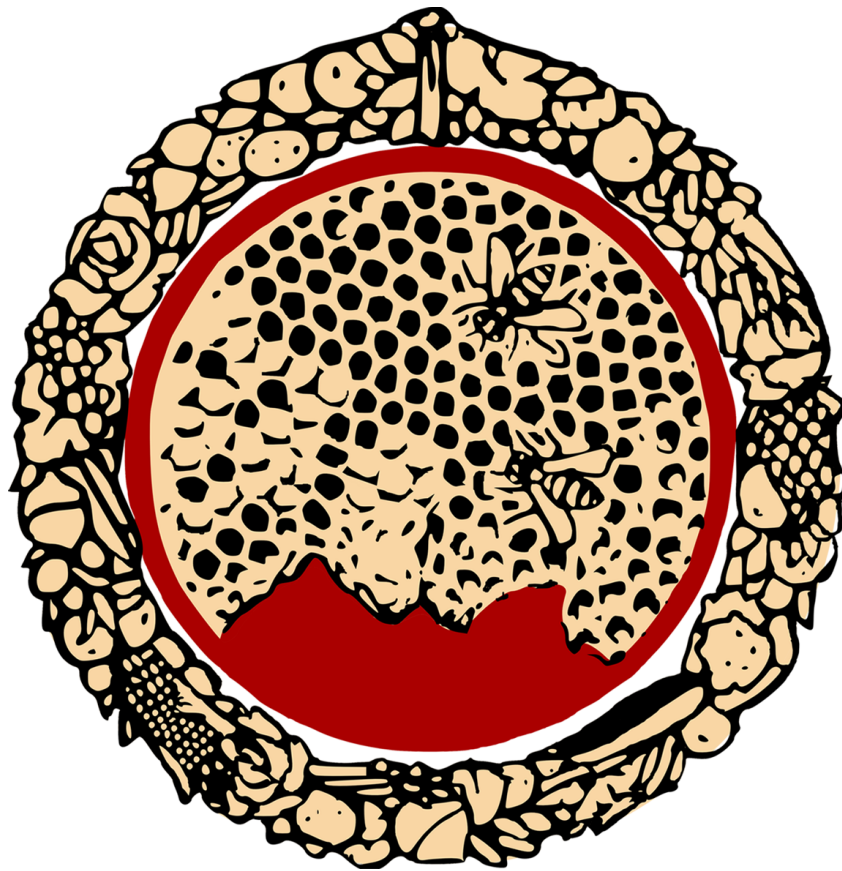


Apicultural Studies at UMass Their History and Future



The Case for Preserving the Apiary January 2011

Compiled and Written by Ken Lefebvre, Class of 2013

Introduction

Today the Apiary Laboratory is employed for research purposes as a part of the continued research on the pathogens negatively impacting the New England bumblebee population. However, despite the importance of this research and the value of this space as both a potential assay laboratory and isolated location for raising bee (and native pollinator) colonies, it is currently listed as a “defer and do not reinvest” property on the 2007 Legacy Building Report¹. The building sits in a state where it could easily be salvaged but due to its limited recorded history, will likely deteriorate as it remains in this category. There is relatively little incentive for the Physical Plant or EH&S to maintain or fix the coding problems associated with the facility as long as it remains on this blacklist, but it remains a unique and valuable asset to the university in contexts both past and present.

This report is intended to—

- Fill in a 100 year gap of the building’s history and that of UMass’s former apicultural research, extension programs and staff.
- Illustrate the relevancy and value of the Apiary today both as a historical campus landmark and as a modern research laboratory
- Show the necessity of continued pollinator research both in extension work and as a part of research, undergraduate & graduate curriculum
 - Agricultural perspective
 - Ecological perspective

The idea of a campus apiary was first conceived for the sole purpose of pollinating the campus orchard. However, by the time the apiary laboratory had been built, President Kenyon Butterfield and the administration had seen and realized a much greater purpose and potential in it. The facility was described in the 1913 Bulletin as “the first in the world erected exclusively for beekeeping”². At the time the laboratory was constructed, beekeeping was considered a new business venture having been widely considered as a hobby or side business for farmers for many decades prior. Just as much of the pioneer work in beekeeping originated in New England, Massachusetts was the first state to create the position for State Inspector of Apiaries. The man who first led UMass’s beekeeping program, a Dr. Burton N. Gates, was also the first to fill this position. As the apiary’s first professor he was originally hired to give a series of guest speaker lectures in the spring semester of 1906– with time, the administration hired him on as a permanent faculty member and built the new apicultural laboratory equipped with all the modern amenities of its time. They saw the opportunity they had, to further research on the diseases and ecology of the honey bee, something that up to that point had never been pursued so thoroughly

¹ The Apiary isn’t listed on the 2007 Building Conditions Report.

² Massachusetts Agricultural College, Bulletin v. 5, 1913. Retrieved from the Internet Archives.

by a public organization of higher education. The unprecedented³ program that was set up in the following years covered both beekeeping on a practical level as an aid to both students and the state's beekeepers and also on a thoroughly academic level, with research being done on apiculture, pollination & pathogens to a level which had never been pursued before by any American institution up to that time⁴. At one point the college was even hosting the National Beekeepers' Association convention biennially, as a conclusion to a beekeeping school taught by the entomology staff in the spring and summer. Professor H.T. Fernald was among the many faculty members to teach in this series of courses.

Over the years UMass would continue to offer beekeeping courses and maintain a beekeeping section of the entomology department right up through the 1970s. The "professor of entomology and beekeeping" at the time, a Dr. Frank R. Shaw, coauthored an important beekeeping and ecology book⁵ with a UC Davis apiologist which was published by Macmillan for many years. In his time on campus Professor Shaw conducted research on honey composition, as well as on the sugar content of different flower nectars in the state and how they might influence which species are present and how these differences affect them as part of a coordinated multi-institutional project⁴. As time has passed more research and theses continued, and a beekeeping course was taught to undergraduates up until sometime presumably in the 1980s. Since that time the apiary became neglected, much of its history had been forgotten- left in the books, and after the medical and urban entomology labs in the building had finished their research it sat vacant for a number of years.

Only recently did it enjoy a brief renewal when former entomology department head Professor Anne Averill hired on a beekeeper to teach short courses. Eventually, due to some form of conflict, and many changes in the department, the teaching of these courses stopped. Since that time the bee colonies that lived there have been moved to a local farm in Amherst.

Today the apiary serves as Professor Averill's office and labs for bumblebee pollination and pathogen research as part of the USDA Coordinated Agricultural Program. This makes the apiary one of only a few labs in the United States studying bumblebees in the scope of both biology and interspecies pathology. It also remains the only place on campus where one can raise a colony of bumblebees (*Bombus impatiens*) and other pollinators in a relatively isolated environment.

As UMass moves forward in the 21st century from a state institution of education to a research university on the national stage, it must continue to not only erect new buildings but to

³ "As was said in the article about official beekeeping at Washington, beekeeping as a serious business is very new; so new, in fact, that the general public has not yet come to take it seriously...The authorities of the Massachusetts Agricultural College were among the first to realize something of the possibilities of honey production...Since Massachusetts was the first state to organize beekeeping work extensively, there was no precedent to serve as a guide. Dr. Gates and his associates are therefore entitled to a great deal of credit for the admirable manner in which the work has developed."

Pellett, Frank C, "*Beekeeping in Massachusetts*", **American Bee Journal**, April 1916. (copy attached)

⁴ Cornell University has the oldest entomology program in the nation, however its current incarnation of its Master Beekeeping program wouldn't be started until the 1950's by a Prof. Dyce. Although it is believed Cornell owned hives through some later portion of the 19th century, it appears its modern bee programs at least coincide or were possibly later than those at MAC/UMass.

Cornell's Apiary Building was constructed in 1955, is much smaller, does not contain an extensive lab space

⁵ Shaw, Frank R.; Eckert, John E.-- *Beekeeping*, Macmillan Publishing, 1960, 1966, 1969, 1970, 1972, 1976, 1977
Intended to supersede "Beekeeping" by the late Everett Phillips (of Cornell)

also rectify the neglect of those which have served it so well from the university's humble beginnings as the Massachusetts Agricultural College. As the world looks towards cleaner technologies and a better understanding of our environmental surroundings, we must start here with the very means by which we harvest from our resources.

There are many unanswered questions about bees ecologically, economically, medically and biologically speaking. The use of native pollinators for better crop yields, the potentially beneficial properties of compounds such as propolis and royal jelly⁶ and the behavior of bees themselves are just some of the promising fields that require further research. At the same time there are many threats to the livelihood of apiculture through new diseases, new pesticides, the introduction of foreign species (e.g. Africanized killer bees) and the extirpation of several species for relatively little known reasons. Having an on-campus apiary laboratory where bees could be raised for further primary research is a valuable asset to a university looking to take the world stage and presents a unique opportunity for UMass to further its name in the scopes of academia and agriculture. National interest in bees has been on the rise⁷ as many species, both honeybees and native pollinators, have seen a decline; the organic gardening movement has led to more people raising their own hives and by buying local produce this could potentially reduce the risks of importing diseases with the mass movement of commercial bees. China, indisputably, has the greatest output of honey and the most ongoing bee research activity of any country in the world. This is a field of research that has great potential for to improve global health. When the apiary was first constructed, the college paved the way with research programs and services never before pursued in the field of apiculture, now as UMass continues its progress a century later, it's time for the history and resources of our campus to be taken a step further.

Faculty History

Alonzo Bradley Esq. (1870-1872)

- “Lecturer of the Honeybee”, gave a series of lectures said to be “the first instruction in this subject given in any agricultural college in this country” as indicated by H.T. Fernald in his history of M.A.C. Entomology¹³.
- President of the Massachusetts Beekeepers' Association⁸ (its older counterpart organization)

⁶ Propolis- a sterile substance composed of flower pollen resin. Informally known as “bee glue”, it is used by bees for structural support and as a means of preventing disease and parasites from entering a hive. Research has thus far found it to be an antibacterial, antiviral, immunostimulant with potentially many medical applications. One recent research study in Japan found it to inhibit tumor growth in lab mice.

Royal jelly- milky substance secreted by work bees, containing many vitamins and enzymes that allow larvae to grow into queen bees. Relatively little is known about its medical applications in humans, though preliminary research has shown it to be a promising treatment for the symptoms of Grave's disease and hyperthyroidism as well as a cholesterol-lowering, antibiotic, wound healing substance.

Both of these substances are taken externally and internally in current usages, however because they contain proteins found almost exclusively in honeybees, both pose the risk of fatal allergic reactions to those allergic to bees themselves.

⁷ On a side note, the First Lady recently had the first Langstroth hives installed on the White House lawn to pollinate the recently installed garden there.

⁸ Report of the President,, 1871, Mass. Agric. College, page 9. Retrieved from Google Books.

Professor Burton Noble Gates (1906-1918)-

- Lectured at UMass in Spring 1906-1910 (1st State Inspector of Apiaries)
- Made full-time assistant professor; Massachusetts Agricultural College begins construction on the Apiary (1910).
 - Promoted from assistant to associate professor of beekeeping (1915)⁹.
- Cofounded the Massachusetts Beekeepers' Association in its present form as the "State Beekeepers' Association of Massachusetts" and unanimously voted its first secretary-treasurer.¹⁰
- Collaborator with the Dept. of Agriculture's Bureau of Entomology from 1907-1910, then again in 1917-1918, much of this work was extended from his duties as apiarist of the college Experimental Station from 1910-1918.
- During his time at the Massachusetts Agriculture College, served as both Chairman and President of the National Beekeeper's Association for a number of years¹¹ (records show 1913, 1914 at least)
 - Served as Chairman for the Committee of Standardization of Beekeeping Supplies¹²
- Awarded medals in 1914 and 1916 in Philadelphia and New York City by the American Association for the Advancement of Science for his research in beekeeping, its effects on cranberry culture and pomology and honeybee diseases and ecology.
- Left the Massachusetts Agricultural College in 1918 to pursue a job as an associate professor of beekeeping at the University of Guelph in Ontario.

Superintendent John L. Byard (1913-1920)-

- Made Superintendent of the Apiary in the Fall of 1913
 - Hired as a response to the demands for more coursework and more bee colonies being installed in Amherst
- Cofounder and the first President of the Massachusetts' Beekeepers' Association, worked alongside Professor Gates as the first Deputy Inspector of Apiaries.
- Helped in extension services, taught a course on Beekeeping for an unknown number of years, duties described as "maintenance of the apiary and its equipment...assist[ing] in laboratory and demonstrational work with students and at conventions."¹³
- Maintained apiary and yards after Gate's resignation, continued teaching courses up until his death in 1920.
 - Before Professor Phillips was hired on, the apiary was operated by Professors Arthur I. Bourne and Henry T. Fernald for the year of 1920.¹⁴

⁹ Mass. Agricultural College -- Bulletin of Faculty changes; Yearbooks, 1915, 1916.

¹⁰ American Bee Journal, November 1912. (Retrieved from Google Books- Harvard Zoological Library.)

¹¹ The Bee-keepers' Review-- Volumes 26-28 (Retrieved from Google Books)

¹² Annual Report- Illinois State Bee-Keepers Association. (Retrieved from Google Books)

¹³ "New Superintendent of the Apiary..." The Bee-Keepers' Review, January 1914
<http://www.archive.org/stream/beekeepersreview2728nati#page/n19/mode/2up>

¹⁴ Fernald, Henry T., *The History of Entomology at the Massachusetts Agriculture College, 1867-1930*. (Amherst: Fernald Club, Special Publication Number 1, Massachusetts State College. 1938.

- Apiary completed, at its time was the only facility of its kind in any higher institution of learning, the only other apicultural research being done at the same level at the time was at being done nationally in Washington. Originally it contained an extensive library on apiculture and pollinators, a laboratory furnished with the most up-to-date equipment of the time, and a museum of beekeeping equipment.¹⁵ (1911)
 - Within a year of the Apiary's construction, it held 50 full-fledged honeybee colonies on its front lawn, with several dozen more in "outyards" towards the edges of the orchard.
 - In this first year, courses in both beekeeping and the ecological impacts of bees on orchards and the surrounding environment were offered to students of the Massachusetts Agriculture College.
- “Demonstrational equipment” was also kept there for use at agricultural fairs and the annual bee convention, the records show little about the nature of this equipment but do state in the 1915 report to the Massachusetts Board of Agriculture that the college had an apicultural tent set up at the fairs in Great Barrington, Worcester and Clinton, and was a success.
 - “It was discovered that the beekeeping tent had become, more than had been anticipated, a feature of the fair and a rendezvous for beekeepers, some spending hours in consultation.”¹⁶
 - It seems likely that these demonstrations included some form of lecture and demonstrations specifically on new techniques in transferring queens, using new processing equipment based on other literature of the same time period.
- The first (of at least 4) spring beekeeping school sessions was offered to state beekeepers in 1910, this school included courses in-
 - Practical beekeeping, taught by Prof. Gates, and in subsequent sessions with Apiary Superintendent John Byard.
 - The honeybee life cycle, Professor Henry T. Fernald.
 - Diseases and natural enemies of bees, Professor James B. Paige
 - Crops foraged by bees, Professor William P. Brooks
 - Bees in horticultural practices, fruit production and impacts on cranberry culture, effects of pesticides and other chemicals on bees, Professor Walter W. Chenoweth
- These spring schools required a separate application along with room and board and would conclude with the annual convention of the National Association of Beekeepers.

Professor Norman E. Phillips- (1921-1923)

- Assistant Professor of Beekeeping, Massachusetts Agricultural College.
- Taught beekeeping and conducted Experimental Station research.
- Resigned to enter the commercial position.¹³

¹⁵ Mass. Agricultural College— Bulletin (1911, 1912, 1913, 1914, 1915, 1916) Retrieved from the Internet Archives. (see attached)

¹⁶ p. 117, 63rd Annual Report of the Massachusetts State Board of Agriculture, 1915, published 1916. (Retrieved from Google Books.)

Professor Morton H. Cassidy- (1923-1926)

- Assistant Professor of Beekeeping, Massachusetts Agricultural College.
- Graduate of M.A.C. Class of 1920.¹
- Suffered asthma to the point he had to leave for a better climate.¹³

Mr. Clayton L. Farrar-(1926-1931)

- Beekeeping Instructor, Entomological Research Assistant
- Kansas State College graduate
- Left in 1931 for an investigational (research) program at one of the Federal Laboratories.

Professor Frank R. Shaw (1935-1972(?))-

- Assistant Entomologist, Mass. Agricultural College Experiment Station- 1930-1934
- Made full-time Instructor in Economic Entomology & Beekeeping (1935)
- Promoted to Assistant Professor of Entomology & Beekeeping (1946)¹²
- Promoted to Associate Professor of Entomology & Beekeeping (1954)¹⁷
- Published the textbook “*Beekeeping*” from Macmillan Publishing with UC Davis Professor John Eckert in 1960
- Meant as a textbook to replace textbook of the same name by late Cornell Professor Everett F. Phillips
- Went on for several editions into the late 1970s
- Conducted research on pollination, species diversity and sugar content of nectar (1960s)

Beekeeping and Apiary Research in Massachusetts

Massachusetts itself has a rich history in the pioneer work and development of apiculture. Today, with little exception, the Langstroth-type hive is used by beekeepers worldwide. Invented in 1851 by Reverend Lorenzo Lorraine Langstroth, “The Father of American Beekeeping”, these hives remain superior to any predecessor due to a design allowing bees to only build honeycomb into set removable frames while effectively preventing the cementing of honeycomb to the sides of the hive box. These new features gave beekeepers superior management and harvest techniques while preventing much of the swarming which would not only put stresses on the beekeeper but also on the colonies themselves.

Reverend Langstroth invented these hives while living in Philadelphia, but it was while he was in Massachusetts that he did much of his work on bee behavioral research which led to the publishing of his most famous work, *The Hive and the Honey-Bee* in 1852. This authoritative book has been in continuous print for over 150 years, has through 40 editions and was first published right here in the Pioneer Valley by Hodgkins, Bridgman & Company of Northampton, MA. Over the years many other beekeeping manuals and research studies have been published right here in Massachusetts and the academic institutions to put out the majority of them has been mainly limited to Harvard and UMass. (see 2nd ¶ of “The Facility” for more on the UMass’s extensive book collection.)

¹⁷ Various editions of the UMass Index.

-Gap between 1943 and 1946 Indexes

Another example of progress in bee research— in the 1800's, it was believed that bee colonies all across Massachusetts were falling prey to the dreaded wax moth¹⁸. However, thanks to extensive research in the century that followed we now know that these problems with wax moths were likely triggered by the spread of some form of disease prior to the infestation of the moths¹⁹. Hives already containing such diseases were weak enough for the opportunistic moths to finish off the colonies. Professor Gates' research at the apiary included extensive work on bee diseases, pollinator efficiency (as opposed to wind pollination), the effects of different species for pollination of cranberries at the UMass Cranberry Station in collaboration with a Dr. Franklin (also celebrating its centennial), new techniques for processing beeswax, the value of bees in horticulture, wintering techniques, and improving the health of stressed or failing hives. One of Gates' studies at the apiary established that the smell of flowers plays only a minute role to bees foraging for nectar²⁰. This study was conducted by using a series of artificial flowers and natural flowers sealed in glass tubes and the data from this study indicated bees were just as likely to visit either types of these flowers as they were to visit the natural, unobstructed counterparts. During the time Gates occupied the apiary, it functioned as a classroom, research lab and a service station for beekeepers across the state as part of the extension program.

The state government of Massachusetts was one of the first states to create a state inspector of apiaries as a means of helping the state's beekeepers and making every attempt to prevent the spread of diseases. Not only did the state Board of Agriculture work closely with beekeepers, but for a time the Highway Department was one of the only in the country to cooperate by planting flower species that were known to attract bees. Much has changed since this time though and unfortunately several of the species planted at the time were not native to the Commonwealth. However, today the Landscape Design section of the Massachusetts Highway Department is working on planting "restoration mixes" of native goldenrod, aster, milkweed, and verbena along with a mix of native grasses to help restore many of the necessary habitats for native insect species. A pilot project also underway involves limiting the mowing of certain sections of highway to an annual basis. By doing this the Dept. of Transportation hopes to create better habitats for native pollinators such as bumblebees.²¹

The Facility

When the apiary laboratory was first built it contained- a total of 50 colonies of bees maintained in its surrounding yards, a few laboratory spaces, an apartment used by caretakers (typically graduate students), a library and a museum with an extensive collection of beekeeping and honey processing equipment. Clark Hill Road, as it is known today, was originally the driveway that led up to the building, which once sat in the middle of the fields at the foot of the orchard and the William Clark estate.

¹⁸ Thatcher, James. *A Practical Treatise on the Management of Bees*. Marsh & Capen, Boston, 1829.

Cited in Dr. Burton Gate's paper- "*Bee Diseases in Massachusetts*", 1908. (see reference 18)

¹⁹ Gates, Burton N. *Bee Diseases in Massachusetts*. Gov't Printing Office, Washington, 1908.

²⁰ Phillips, Everett- "*Beekeeping*", Macmillan Publishing, 1916

²¹ Correspondence with Tara Mitchell, Landscape Architect for MassDOT

Today the library collection that once occupied the apiary has since been split between two separate collections. The official detailed Dewey Decimal classification for “apicultural literature” was one of Dr. Gate’s many accomplishments²² and over the years he amassed a large collection of apiological books, some of which are still available at the W.E.B. Dubois Library today.²³ An “online exhibit” of this collection is available on the library website but does not anywhere mention the apiary or the other origins of the books in the collection. The portion of the apiary library that was personally owned by Dr. Gates was acquired after his death by the University of Guelph in 1973. Gates spent a portion of his years teaching there and worked with the Ontario government filling many of the positions equivalent to those he had held while in Massachusetts.

Relatively little is known about the history of the contents of laboratory spaces themselves. Originally the basement held space for wintering the bee colonies as well as another room for wax processing. In a more recent time the lab spaces served Professor John Edman, a medical entomologist who spent a large portion of his career studying mosquitos as disease vectors in different regions of the world. There are 4 laboratories, of which only 2 are currently in use, rooms 101 & 102. These lab rooms on the first floor have many windows allowing for plenty of natural light in the workspaces, a chalkboard, modern lab tables²⁴, a humidity/temperature control chamber, and a fume hood²⁵. The other 2 labs are located in the basement; the medical entomology lab contains several cabinets, a large basin for sinks and several freezers. The other laboratory space, the wetlab room, is completely empty at this time. The space could be put to good use as it occupies roughly half of the basement space, and could easily accommodate new service benches and lab desks. The space would need some renovations including a new window, either a new door or more permanent replacement for the plywood that currently blocks the doorway and possibly some form of additional ventilation out the side of the building.

Above the laboratories are a series of rooms once used as an apartment, all of these are in relatively good shape and would still be usable apart from an exit violation of the fire code. The only likely changes needed would include a replacement for a rusty steam pipe on the first floor, and there are several possible configurations for the installation of a ladder or traditional fire escape on the building. As a historical building it would seem likely eligible for exclusion from this additional exit upstairs but due to its use as a lab building this makes such an exemption less than possible. A couple potential configurations for a fire escape could include adding a new dormer to one of the other rooms or tearing down the unused garage to the south side of the building and putting a fire escape where it wouldn’t be as noticeable from the road.

The only room upstairs officially usable at this time is the bathroom which at one time may have contained a shower while the upstairs was used as an apartment. Sometime after 1918 (around the time Dr. Gates left UMass), the upstairs dormers were added, and it can be assumed that around this time the upstairs may have changed functions as an office for graduate students.

²² University of Guelph- Burton Noble Gates Apicultural Collection

²³ Steinmetz, Richard A. UMass SCUA, “Apiculture and Culture”
<http://www.library.umass.edu/spcoll/exhibits/bees/index.htm>

²⁴ Likely installed while Dr. Frank R. Shaw was professor of beekeeping

²⁵ Functional, currently vents through upstairs bathroom, requires external “squirrel cage” fan like those on Fernald to meet current EH&S guidelines

As a housing space, the upstairs could comfortably fit 2-3 graduate students with ample space for all common amenities, and as an office space the 4 rooms could easily be used as office space for 5-7 graduate students in the Plant, Soil & Insect Sciences department. With the university looking for more space and simultaneously looking to rise in the ranks of world institutions of education, these rooms could provide the necessary space for future research while preserving the rich history of UMass and leaving a small footprint in the Central housing area, one of the most beautiful parts of the campus. If the apiary is taken off of the “do not reinvest” then it would cost relatively little to get it back up to its former appearance. As a small, uniquely purposed facility at 100 years old, this facility would seem highly eligible for some form of grant if it was included in a historical district at UMass.

Selected List of UMass Research Theses on Bees and Other Pollinators

The effect of certain modern pesticides on *Apis mellifera* L. and *Bombus* spp.
by Donald J Sutherland, 1957, University of Massachusetts for an M.S.

The effects of Sevin, alone and in fungicidal combinations, and DDT on the honey bee, *Apis mellifera* L.
by John R Lupien, 1960, University of Massachusetts for an M.S.

The comparative toxicity of selected organic phosphate and carbamate insecticides to the honey bee.
by Robert Edward Grahame, 1967, University of Massachusetts for an M.S.

A measure of some factors affecting the development of the honeybee colony
by Clayton Leon Farrar, 1931, Massachusetts State College

A study of some of the physical factors influencing the sugar concentration of nectar
by Milton George Savos, 1954, University of Massachusetts for an M.S.

The culture of bee forage crops
by Zhiliang Pan, 1997, University of Massachusetts for an M.S.

Spatial variation and tradeoffs in species interactions
by Holly Bernardo, 2010, University of Massachusetts for an M.S.
Organismic and Evolutionary Biology

Special thanks to —

- Tara Mitchell, Landscape Architect of the MassDOT Highway Division, for filling me in the DOT's current efforts to expand pollinator habitats
- The Library Staff, for had it not been for their many uploads to the Internet Archives, this report would not have been possible.
- Kat, without whose encouragement this report may not have written.

SPRING BEEKEEPING SCHOOL

May 31—June 14, 1916

This itinerant school is held in Amherst once in three years and extension schools are planned for different sections of the state during the intervening years. It is an intensive course, primarily for a limited number of practical beekeepers. The course, conducted by a strong staff of specialists, occupies seven hours daily for two weeks (Saturdays being devoted to excursions), and comprises lectures, laboratory practicums and field excursions. It is under the direction of Burton N. Gates, Associate Professor of Beekeeping.

[22]

The College maintains a practical beeyard of about fifty colonies, as well as outyards, with a well-appointed beehouse and laboratories, besides a wax working laboratory, library, and beekeeping museum. Exceptional facilities are afforded the student in this subject.

Courses

1. *Practical beekeeping.* Lectures: laboratory practice in the general work of the beekeeper; beekeeping equipment, practices in the preparation of materials, location of the apiary; commencing with bees, handling of bees, practice in beeyard procedure; spring manipulation, fall preparation, wintering; extracted-honey production; bee diseases and their treatment, apiary sanitation; making increase, elements of queen rearing, etc.

BURTON N. GATES Associate Professor of Beekeeping
JOHN L. BYARD Superintendent of the Apiary

2. *Life of the honeybee.* Lectures.
HENRY T. FERNALD Professor of Entomology

3. *Special problems of the beekeeper.* Lectures: demonstrations in requeening, the races of bees, the introduction of queens; swarming and handling swarms, comb honey production, enemies of bees.

JAMES B. PAIGE Professor of Veterinary Science

4. *Crops foraged by bees.* Lectures: field excursions.
WILLIAM P. BROOKS Director of the Experiment Station

5. *The relation of bees to the pollination of plants, including coloration, odor, nectar secretion.* Lectures: laboratory work in blossom structure and dissection.

A. VINCENT OSMUN Associate Professor of Botany

6. *Bees in horticultural practices; fruit production, market gardening, cranberry culture and greenhouse cucumber growing; beekeeping as affected by spraying practices.* Lectures: field work.

WALTER W. CHENOWETH Associate Professor of Pomology

It is desirable to apply for this course early as it has been found necessary to limit the school to fifteen students. Students will be accepted in the order of application as shown by date of letter.

A fee of two dollars is charged to cover all laboratory expenses. Equipment such as is made by the students, may be purchased at cost. Full announcement of this course will be issued about April 1, 1916.

The Annual Convention, formerly held as the conclusion of this course, is announced for March 14-16, inclusive, during Farmers' Week. (See above.)

Listing for the Spring Beekeeping School,
(*Mass. Agricultural College Bulletin*,
1915-1916.)

Beekeeping class in the Apiary yard.
Date Unknown
(UMass Special Collections)



Courses in Beekeeping.

65. **III. INTRODUCTORY BEEKEEPING.** — For juniors; seniors may elect. Designed to meet the demands of the horticulturist as well as of the prospective honey producer, and consists of a detailed study of the normal behavior of the honey bee and the colony as a whole, followed by an explanation and consideration of the various manipulations employed in the practical work of the apiary. In proportion to their relative importance, time is also given to the following topics: development and structure of the individual, sources of nectar, queen rearing, the prevention and control of bee diseases, and the marketing of honey. In so far as possible, the laboratory work parallels the lecture work, and is planned to familiarize the student with the most approved methods of beekeeping in the various branches of farming.

3 class hours.

2 2-hour laboratory periods, credit, 5.

Assistant Professor PHILLIPS.

85. **I. ADVANCED BEEKEEPING.** — For seniors. Intended for those who expect to make beekeeping the principal part of their business, and is a continuation of Course 65, with a detailed consideration of the more important features of the industry, such as: wintering, spring management, swarm control and increase, and production and care of the crop. Other special topics considered are: commercial queen rearing, identification and treatment of the various bee diseases, the inside temperature of the hive, and beekeeping literature. The aim of the course is to fully equip the student for commercial beekeeping. The laboratory work takes up special manipulations, and attention is also given to the problems of beekeeping.

2 class hours.

1 2-hour laboratory period, credit, 3.

Assistant Professor PHILLIPS.

Course listing for Beekeeping classes
taught by Professor Phillips
(M.A.C. Bulletin, 1922)

ENTOMOLOGY.—BEEKEEPING. — For this work the main office, museum and lecture rooms are in the entomological building. There is also an apiary covering approximately two acres which will consist of about fifty colonies of bees in various types of hives and maintained for the several practical and experimental purposes. The apiary also includes a collection of nectar-yielding plants representative of the native flora as well as of the more important nectar sources from other localities. Especial opportunity is therefore given for a study of this fundamental problem of forage. Upon the apiary site is an eight-room building (the first in the world erected exclusively for teaching beekeeping) modeled to meet both the requirements of teaching and of a practical apiary. This building contains a boiler room, capacious wintering cellar, wax extraction room, general carpenter and work shop, laboratory, office, honey extraction room and stock room. The beekeeping equipment also includes an unexcelled collection of apicultural implements, natural history specimens and other curiosities. Practically every device used in American apiculture is available, it being the aim of the department to procure new inventions and implements as fast as they appear for the purpose of study and comparison. Available to the students is a private library of apicultural literature consisting of upwards of 700 volumes and papers, possibly the most complete collection in the country. This entire equipment is acknowledged unique in model and in completeness for the United States and for the world.

Description of the building from the
Massachusetts Agricultural College
Bulletin of 1913.

97. (I) 98. (II) Special Problems in Entomology

Supervised problem work in entomology or **beekeeping** for qualified students. Prerequisites, Entomology 26 and permission of staff. Credit, 1-3. Staff.

APICULTURE

66. (II) Beekeeping (1964-65)

Honeybees and their relatives, structure and biology of bees, methods of management, diseases, pollination, queen rearing, honey production, and history of **beekeeping** are included. Given in alternate years. Prerequisite, Entomology 26 or Zoology 1. 2 class hours, 1 2-hour laboratory period. Credit, 3. Mr. Shaw.

Course listing for Beekeeping
classes taught by Professor Shaw
(M.A.C. Bulletin, 1965)

BURTON N. GATES, A. M., Ph. D., *Assistant Professor of Beekeeping.*

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(M.A.C. Index)